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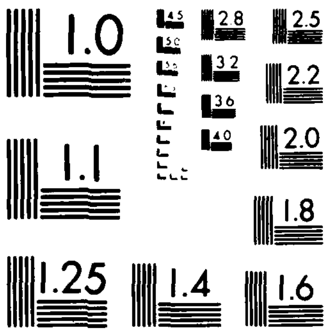

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How Space - The Fourth Operational Medium - Supports Operational Maneuver

by

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This monograph examines space doctrine and space operations, and how they support operational maneuver. The concept of operational maneuver is developed with a view to enhancement through space support. Potential space support and ground maneuver enhancement systems are identified. Current methodologies that integrate them into operational maneuver are examined verifying that our doctrine and practice adequately integrate the new systems and capabilities. Recommendations to better integrate space and operational maneuver are presented.
The monograph first examines the early development of aviation in an attempt to learn from the early aviation visionaries the ways they integrated aviation into operational maneuver. Their failures and successes are noted. Historical examples of operational maneuver are examined, and inherent key factors are extracted and developed. Doctrinal factors affecting operational maneuver are consolidated and presented. Space doctrine is examined with a

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ABSTRACT

HOW SPACE - THE FOURTH OPERATIONAL MEDIUM - SUPPORTS OPERATIONAL MANEUVER by MAJ Frank P. Janecek, USA, 56 pages.

This monograph examines space doctrine and space operations, and how they support operational maneuver. The concept of operational maneuver is developed with a view to enhancement through space support. Potential space support and ground maneuver enhancement systems are identified. Current methodologies that integrate them into operational maneuver are examined verifying that our doctrine and practice adequately integrate the new systems and capabilities. Recommendations to better integrate space and operational maneuver are presented.

The monograph first examines the early development of aviation in an attempt to learn from the early aviation visionaries the ways they integrated aviation into operational maneuver. Their failures and successes are noted. Historical examples of operational maneuver are examined, and inherent key factors are extracted and developed. Doctrinal factors affecting operational maneuver are consolidated and presented. Space doctrine is examined with a view to enhance operational maneuver. Potential space support systems available now to the far term are listed and integrated into operational maneuver; while systemic shortcomings that limit space integration are identified. Finally, recommendations essential to integrate space support and operational maneuver are presented.

Space support operations are currently centralized at the highest levels. This centralization reduces their availability to and timely support of the operational commander. However, to maximize the benefit and increase their impact on operational maneuver, space support must be decentralized; request procedures must be responsive and streamlined; products declassified; systems designed to make the space aspect transparent to the user; and, training expanded throughout the Army, not just given to the selected few "space experts". Above all, space support must be integrated throughout the Army and execised regularly in peacetime so the support systems will be useful and effective in wartime.

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I. Introduction

> What appears to be a logical future program? The answer is not easy. It is very difficult to make a firm prognosis on military need during a twenty-year period for something as new and revolutionary as ballistic missiles, earth satellites, and space vehicles. We are somewhat in the same position today as were military planners at the close of the first world war when they were trying to anticipate the employment of aircraft in future wars.
>
> General Bernard A. Schreiver (1959)[1]

The recent acceptance of three levels of war - tactical, operational, and strategic - has fostered a resurgence of US Army thought and writing about doctrine and related issues. The 1982 and 1986 versions of FM 100-5, OPERATIONS, develop and expand ways of fighting that stress the four basic tenets of Initiative, Agility, Depth, and Synchronization.[2] This way of fighting is embodied in AirLand Battle whose focus is on the operational level of war.

Simultaneous with this rebirth of the operational level, there has developed a potential capability in space that can significantly change the way we fight wars. The potential to enhance combat power is achieved by linking space systems to ground maneuver. The President of the United States recognized this potential when he authorized formation of the U. S. Space Command (USSPACECOM) after recommendations by both the Joint Chiefs and the Secretary of Defense.[3]

Space has been hailed as the Fourth dimension, The new high ground, and as "an inconceivably large place, a forbidding and unpleasant milieu where men

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[1] AFM 1-6, Military Space Doctrine, (15 October 1982), p.2.

[2] FM 100-5, Operations, (Washington DC, May 1986), p.15

[3] Office of the Assistant Secretary of Defense News Release, "Formation of United States Space Command (USSPACECOM)", November 30, 1984.

can do some things they consider useful but at high cost and considerable risks."[4] It has also been said that "the future of the Army is not in space but in the mud."[5] Space is a place not a specific weapon system. Space provides the high ground that allows new systems to exploit the inherent advantages gained from the high ground. A perspective of the high ground is shown at Figure 1. Space technology, superior and enhanced weapons, and space systems combine to form spacepower that can be exploited to enhance ground force mission accomplishment. Developing a proper union of systems and doctrine that exploit space is our challenge.

Operational maneuver is one key component of AirLand Battle. Developing and integrating space power to improve and enhance operational maneuver can avoid the pitfalls that have historically accompanied the introduction of superior weapon systems and associated concepts into the military. In his book *Ideas and Weapons*, Dr. Holley relates:

> ...three specific shortcomings in the procedure for developing new weapons. These shortcomings appear to have been: a failure to adopt, actively and positively, the thesis that superior arms favor victory; a failure to recognize the importance of establishing a doctrine regarding the use of weapons; and a failure to devise effective techniques for recognizing and evaluating potential weapons in the advances of science and technology.[6]

Maneuver occurs at the strategic, operational and tactical levels. Strategic maneuver projects power and national resolve by world-wide deployment of operational and tactical units. The goal of strategic maneuver is prevention of conflict before it starts, by movement of forces strategically a

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[4] Bruce Briggs, "The Army in Space: New High Ground or Hot-Air Balloon?", Military Review, (December 1986), pp.44-49.

[5] Ibid.

[6] I.B. Holley Jr. Ideas and Weapons, (Connecticut: Archon Books, 1971), p.10.

force can be positioned to project combat power if required. Operational maneuver seeks a decisive impact on the conduct of a campaign. It attempts to gain positional advantage before battle and to exploit tactical successes to achieve operational results. Maneuver at the tactical level is one of the dynamics of combat power that combines with firepower, protection, and leadership to produce the ability to fight. Tactical maneuver seeks to set the terms of combat in a battle or engagement.[7] Space systems and weapons enhance operational maneuver and improve the way we fight wars. Therefore, we must develop appropriate uses of space and adjust doctrine to capitalize on the unique capabilities space systems provide.

In researching and preparing this paper, I sought to learn from the early writers and visionaries of aviation and air power, exploring how they integrated aviation into enhancing operational maneuver. To my dismay, I found that the path taken by the early pioneers, Mitchell, Douhet, Henderson, Trenchard, and Arnold, to name a few, led away from integrating air power into operational maneuver. This is not to say that some of their thoughts and principles are no longer appropriate; they are. However, if we follow the general ideas they developed, we could end up with the same conditions that existed in the late '40's and mid '50's when air power was focused on strategic bombing at the expense of tactical and operational support to ground units. The lessons learned during WW II had been neglected after the war as the Air Force focussed on breaking its ties with the Army and developing separate missions, functions, and doctrine. My review of the early years of aviation convinces me that the aviation pioneers did not explore and integrate airplanes into ground or operational maneuver. We should learn from their examples what not to do. The Army must make a conscious and determined effort to integrate and use the

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[7] FM 100-5, p.12.

capabilities and advantages obtained by integrating space systems into maneuver warfare doctrine.

Consequently, this paper focuses on both space and operational maneuver. "How can space support operational maneuver?" is the question this paper will attempt to answer. To develop an appropriate answer, I will review the early years of aviation to identify shortcomings; reflect on battles that demonstrated operational maneuver in an attempt to gain insight into maneuver requirements; examine current doctrine; identify potential space uses that support operational maneuver; and conclude with organizational and doctrinal changes that enhance integration of space into operational maneuver.

The Army must develop and integrate space system capabilities into TOE organizations and doctrine and, if necessary, change the organizations and doctrine to integrate space into ground operations. The Army's place **is in the mud,** but with the perspective and advantages of looking and shooting from space. Let's now look briefly at the early years of aviation.

II. Historical Experiences

AVIATION

Aerial systems have long been recognized as a technological revolution in the conduct of war. What started as a reconnaissance capability by balloon was enhanced by the airplane. Even before aeronautics had impacted on future wars, Billy Mitchell, as an American proponent of air power, envisioned aviation as the 2nd line of defense against invasion of the United States. He thought aircraft would be useful for reconnaissance and counter reconnaissance operations. Aircraft would serve as artillery spotters, they could destroy enemy submarines and ships and disrupt the operation of his minelayers.

Therefore, control of the air was critical to maintenance of an effective defense.[8]

Douhet envisioned air power as the use of space off the surface of the earth to decide war on the surface of the earth.[9] Aircraft were offensive attack weapons that could destroy the enemy's homeland along with his will to fight. He was convinced that strategic bomber aircraft could inflict such damage in a short period of time that t' ıcked country would lose the will to fight.

The early air power proponents and theorists attempted to use airplanes separated from the ground forces in a strategic bombing role, in a tactical ground support role, or in an interceptor/pursuit role. From these views grew the great debates over the types and mix of aircraft necessary: bomber, pursuit, or reconnaissance. The only agreement was that an army without aviation "was doomed to failure against one with it."[10] Neither of these views used air power to enhance operational maneuver. Development of a doctrine that exploited air power in conjunction with ground forces had to wait until WWII.

In 1936, German development of aviation was at least five years ahead of that of the United States and Great Britain and eight or nine years ahead of that of France.[11] Prior to WWII, the Germans developed aircraft to meet the requirements of air superiority (ME109s); close air support (JU-87 dive bombers); light to medium bombers (DO-17s, HE-111s); and general purpose,

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[8] Alfred F. Hurley, Billy Mitchell Crusader for Air Power, (Bloomington: Indiana University Press, 1975), pp. 19-24.

[9] Giulio Douhet, The Command of the Air, (Second Edition 1927, SAMS Reprint AY86/87), p. viii.

[10] Hurley, p 29.

[11] Al Williams, Airpower, (New York: Coward-McCann, Inc., 1940), p 70.

liaison/reconnaissance/transport. German air power was closely integrated into the ground battle with decisive effect.

> It was airpower that cast the die for the Polish campaign in nine days. It was airpower that had invaded and seized the strategic points in Norway. It was airpower that had transported entire infantry divisions into Norway by air. It was airpower that had maintained the control over the Skagerrak in the face of the entire British seapower, the greatest naval force afloat. It was airpower that defied the great seapower protecting landings of British Expeditionary Forces on the Norwegian coast. It was airpower that turned the Allied evacuation from Norway into a disastrous rout with the soldiers pleading: "For God's sake, send us airplanes." And it was airpower which smashed the armies of Holland, Belgium, England and France in the European Campaign.[12]

It must be recognized that air power alone did not win any of these battles or campaigns but that victory required the combined effects of each combatant arm and service.

Meanwhile, the French failed to develop a doctrine that integrated air power. At the start of WW II the French Air Force used outdated aircraft and throughout the battles of May and June 1940 they inadequately coordinated air power's effects. After the German invasion in May 1940, French airplanes were scattered throughout France and never again properly or fully employed.[13] French failure to develop and practice a workable doctrine for employment of air power significantly contributed to their defeat.

> As late as 30 May, the Minister of Air, M. Laurent-Eynac, revealed that, in all but fighters, the French Air Force was actually stronger in numbers than on 10 May...According to French sources, by the Armistice of 22 June, the French Air Force was still stronger and better equipped than it had been on 10 May.[14]

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[12]Ibid., pp.387-388.

[13] Alistair Horne, To Lose a Battle France 1940, (Middlesex:Penguin Books,1969), pp.493-494.

[14]Ibid., p.614.

By 1942 eleven significant lessons of modern air power had been recognized and developed in the United States, some of which are still held as true. These were:

"1. No land or sea operations are possible without first achieving control of the air above...

2. Navies have lost their function of strategic offensive...

3. The blockade of an enemy nation has become a function of air power...

4. Only air power can defeat air power...

5. Land-based aviation is always superior to ship-borne aviation...

6. The striking radius of air power must be equal to the maximum dimensions of the theater of operations...

7. In aerial warfare the factor of quality is relatively more decisive than the factor of quantity...

8. Aircraft types must be specialized to fit not only the general strategy but the tactical problems of a specific campaign...

9. Destruction of enemy morale from the air can be accomplished only by precision bombing...

10. The principle of unity of command, long recognized on land and on sea, applies with no less force to the air...

11. Air power must have its own transport..."[15]

What the United States failed to demonstrate in the above lessons was an integration of air power into ground operations. By 1942 the United States had still not learned the lessons of air-ground integration.

OPERATIONAL MANEUVER

[15]Maj Alexander P. Seversky, Victory through Air Power, (New York: Simon and Schuster, 1942), pp.123-149.

Operational maneuver is the movement of forces to gain positional advantage over the enemy. The Germans accomplished this in 1940 while the French did not. Operational maneuver was accomplished prior to the main battle, set the stage for the tactical battle, and then exploited tactical success. Other campaigns provide useful looks at operational maneuver and will be briefly examined.

FM 100-5 recounts how Gen. Grant made an operational maneuver during the battle of Vicksburg when he moved south of Vicksburg, crossed the Mississippi River and then maneuvered toward Jackson, Mississippi, to threaten both Jackson and Vicksburg. This operational maneuver prevented the Confederate forces from uniting and allowed Grant to defeat Generals Johnston and Pemberton in five successive engagements.[16] It was a bold and totally successful operational maneuver even though he placed his force at great risk.

Both the Allies and the Germans used operational maneuver during the Battle of the Bulge. The Germans in a monumental feat of operational maneuver moved V and VI Panzer Armies to positions of relative advantage opposite weak Allied forces in the Ardennes. Using deception and economy of force, the German High Command was able to withdraw from the line, reposition and concentrate a force of 7 Panzer Divisions and 8 Infantry Divisions.[17] Some of the German forces were detected and identified but their intended use was not. The result was operational surprise when they attacked on 16 December 1944 against the weakly held section of the front. General Eisenhower responded very quickly to the threat. In seven days, during adverse weather, a force of 29

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[16]FM 100-5, pp.91-94.

[17]Charles B. MacDonald, A Time For Trumpets, (New York: Bantam Books, 1985) pp 644-655.

divisions was quickly maneuvered to block the German offensive.[18] Three divisions moved from England while of the remainder only four had not been in contact or committed prior to the offensive. This was operational maneuver on a tremendous scale and with no advance warning. Units were withdrawn from their current missions, given new orders and routes of march and put on the road in the shortest possible times. Gen Eisenhower did this along the length of the First and Third Army's fronts. All actions necessary to accomplish the mission were condensed to the absolute shortest duration. Gen Patton's diversion and movement of the Third Army from a planned attack toward the East to a 150 mile road march North followed by an attack into the flank of the German penetration was incredible.

What actions made these operational maneuvers possible? First, without a clear understanding of the enemy's intention, orders were issued with a fairly clear intent: Blunt the nose of the penetration while strengthening the shoulders. Then after the situation had developed, the decision to counterattack at the waist of the penetration instead of the base was made. In this case, the first requirement for successful operational maneuver was a clear understanding of initial intent. Second was relief from current missions and identification of priority of effort. How important was the mission and thus the operational maneuver to support it? Operational maneuver sought a decisive impact on the campaign.

Mobility was important. Patton's Third Army as a mobile armor force needed no major assistance, while airborne divisions such as the 82nd and 101st needed trucks to transport the soldiers. Force mobility was a factor that determined how fast they could mass to commit a major portion of their combat power. Logistics and resource management were also important.

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[18] Ibid., pp.630-643.

Patton's trains were able to move with or soon after his units. On the other hand, the 101st Airborne Division trains were slow to get to Bastogne and the subsequent shortage of resources (ammo, fuel, food, and medical supplies) adversely affected the defensive effort. Knowledge of the enemy and terrain, or lack of it, had an impact on the ability to conduct operational maneuvers. An initial identification of factors that affected operational maneuver would include: intent, designated priority of effort, command and control, communications, force type, mobility, ability to mass combat power, management of logistics, intelligence on terrain, weather, and the enemy, and surprise.

Another conflict that provides additional examples of operational maneuver is the Korean war.

> Two examples rising from the same conflict demonstrate markedly different approaches to operational maneuver. In the first, the September 1950 UN counteroffensive in Korea coordinated a breakout from the Pusan perimeter with an amphibious turning movement at Inchon--one overland line of operations, the other by sea. In the second, the November 1950 Chinese counterattack (some 18 divisions) across North Korea featured infiltration on multiple land axes through rugged terrain, lightly equipped forces trained in night movement and attack, and frontal attacks to fix forces for light infantry bypass, encirclement, and deep attack for decisive results. The UN maneuver was characterized by shipborne and motorized logistic support to propel and sustain the attack, evacuating casualties as they were incurred. The Chinese maneuver was characterized by man and animal packed logistics augmented by captured materiel, simple and reliable weapons needing only operator maintenance, and far less concern for disposition of casualties. Both approaches made best use of inherent military styles and strengths against enemy vulnerabilities; they did not (and could not) match strength with strength. Both were extremely successful. Both were surprises. Neither, however, was so successful as to be a warstopper.[19]

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[19] James Toth, Higher Direction of Military Action. (National Defense University, 1986) (Second Draft), p.66.

Each of the above instances was a bold action with potentially significant results. The operational maneuver factors evident were: surprise, intent to achieve decisive results, mobility, force tailored to the mission, concern for logistics, massing of forces at the decisive point, execution of classical turning movements and penetrations, exploitation, intelligence on enemy and friendly force dispositions, knowledge of terrain and weather, and integration of Army, Navy, Marine, and Air Force efforts, ie. Joint Operations. Operational maneuver should be a major step on the road to campaign success if it is not a warstopper by itself. Once initiated, operational maneuver must be given the men and material to carry it through to completion without pause or hesitation.[20]

There are recent instances of space systems supporting operational maneuver. The 1973 Egypt-Israeli War provides an example where U.S. satellite and SR71 reconnaissance systems were used to identify Egyptian force movements across the Suez canal. Israeli identification of Egyptian force movements allowed a successful counter-attack, crossing of the Suez canal, and encirclement of the Egyptian Third Army. Soviet satellite imagery was also used by the Egyptian high command in determining Israeli defences and the size and locations of their counter-attacks.[21] Satellite systems have also had an impact on other conflicts as diverse as the Iran-Iraq war, the Falkland Islands campaign, and the Chad rout of the Libyans in April 1987.

The previous experiences are useful in identifying requirements and gaining insights into operational maneuver and a limited look at the use of space systems support to modern battles.. The next chapter will review

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[20]Ibid.

[21]Lt. General Saad El Shazly, The Crossing of the Suez, (San Francisco: American Mideast Research, 1980), pp.115,116,252,274.

current doctrine for maneuver, aviation, and space as it relates to operational maneuver.

III. Current Doctrine

MANEUVER

When we consider operational maneuver doctrine , we must consider it in a joint context since each Service plays a part. Army doctrine on operational maneuver is found primarily in FM 100-5, Operations, which discusses both tactical and operational maneuver . FM 100-5 states "maneuver is the movement of forces in relation to the enemy to secure or retain positional advantage. It is the dynamic element of combat...Maneuver occurs at both the operational and tactical levels."[22] Effective maneuver keeps the enemy off balance and thus also protects the force. It continually poses new problems for the enemy, renders his reactions ineffective, and eventually leads to his defeat. For force preservation and security, operational maneuver requires protection from enemy air power.[23]

Operational maneuver seeks a decisive impact on the conduct of a campaign. It attempts to gain advantage of position before battle and to exploit tactical successes to achieve operational results.[24] "Operational maneuver aims at deep and decisive objectives and features the massing, protection, projection, and support of Corps or Army level penetrations or

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[22]FM 100-5, p. 12.

[23]Ibid.

[24]Ibid.

turning movements."[25] Summarizing, tactical maneuver seeks to set the terms of combat in a battle or engagement, and operational maneuver becomes large unit movement that results in seizure of a positional advantage.

Airborne, airmobile, light infantry, mechanized infantry and armored forces can all conduct operational maneuver. Operational maneuver forces will have different requirements depending on the mission and force mix. Airborne and light infantry forces may require truck transport and/or US Air Force lift support either intra-theater or inter-theater depending on the movement distances. Mechanized and armored forces may move by ships, rail, air, or road depending on their movement distances and destination. Each force requires tailored movement to meet its operational mission.

By reviewing the current doctrine on operational maneuver, it is possible to develop a list of factors that support operational maneuver. Doctrinally, operational maneuver is affected by the mission, the force and its mobility, intelligence preparation of the battlefield, the terrain, weather, the enemy, logistic support, deployment capability both friendly and enemy, C^3I, time, and political considerations.

Additional insights into maneuver are gained from the Wass De Czege combat power model, maneuver effect, which evaluates small unit (tactical) maneuver in four general areas: unit mobility, tactical analysis, management of resources, and command, control and communications. Integrating the identified doctrinal factors with an expanded Wass De Czege model that incorporates the requirements for large unit (operational) maneuver, we can produce the consolidated list of operational maneuver factors found at Table 1. This list includes the consolidated headings of: operational and mission

[25] Toth, p.66.

analysis, intelligence and tactical analysis, security and deception, command and control, communications, and management of resources.

AVIATION

Air Force doctrine found in AFM 1-1 lists general aerospace missions, specialized tasks and the Air Force role in support of ground forces. The US Air Force's first consideration in employing aerospace forces spanning the range from strategic to tactical actions is gaining and maintaining freedom of action and control of the aerospace environment.[26] Air Force missions that affect or support the ground commander are Counter Air, Air Interdiction, Close Air Support, Special Operations, Airlift, Aerospace Surveillance and Reconnaissance, Electronic Combat, Warning, Command, Control, and Communications, Intelligence, Psychological Operations, and Weather Service. Support to Army forces is specified or implied in the above missions. Support for ground maneuver is addressed only as a principle of war and specific support for operational maneuver is not addressed.

AFM 1-6 is Air Force Military Space Doctrine. The manual preceded the creation of the U.S. Space Command. However, t [illegible] a number of key elements in this space doctrine manual. It states one of [illegible] ilitary interests in space is to exploit the potential of space to conduct op[illegible]ns that further military objectives. There are specified key attributes of space systems that enhance their integration into existing military forces. They are: Global Coverage - including access to areas denied to terrestrial forces. Economy - recognizes that some functions are more economical when operated in space. Effectiveness - some activities are more effective when conducted from space. Flexibility - space systems provide flexibility in meeting requirements. Efficiency - certain functions can be performed more efficiently in space.

[26] AFM 1-1, Basic Aerospace Doctrine, (March 1984), pp.2-11,2-12.

Redundancy - functions accomplished in both space and on earth provide mutual backup.[27]

AFM 1-6 states that DOD has assigned the Air Force basic responsibility for space operations. Within this directive, there is a requirement to conduct military operations within the unified or specified command structure and sustain the potential for military operations by applying superior, space-related technologies. Potential war fighting missions have been identified and include the ability to damage widely distributed enemy counterforce and countervalue surface targets and enhance the value of current weapon systems by providing timely suppression of enemy defenses. Additionally, space weapons could be used to gain or maintain control and dominance of space and against enemy space lines of communication.[28] Air Force Space doctrine is dynamic by nature.

SPACE

Space is a relatively new dimension for the services. The Unified command that controls and integrates space is likewise new. In September 1985 the USSPACECOM was established with the missions of space operations and aerospace defence. Under space operations, USSPACECOM is responsible for space control - assuring free access to space; and space support - supporting other warfighting CINCs by operating satellite systems that provide support. Under aerospace defense, USSPACECOM is responsible for ballistic missile defense planning and requirements development for aerospace surveillance and warning.

Army organizations that develop and integrate space support are even newer. In August 1986, the US Army Space Agency (USASA) was established as

[27]AFM 1-6, pp.5-6.

[28]Ibid., pp.6-9.

the Army component to USSPACECOM. USASA's mission "is to plan for, and as directed, organize, train, operate, and maintain Army forces to support USSPACECOM space operations; to advise and assist Army elements and US Government agencies on Army space matters and to support mission development for current and future space activities."[29]

Additionally,

> In June 1986, the US Army Space Institute (USASI) was established by TRADOC at Ft. Leavenworth, Ks. USASI is the Army's specified and personnel proponent for space and represents the Army Space User in the Concepts Based Requirements System. The Institute, in conjunction with TRADOC Schools and Centers, is to develop, integrate and disseminate space doctrine and concepts, describing how to apply space systems and technology to land warfare. The Institute is to monitor and assist AMC, SDC, and the TRADOC schools and centers in the requirements definitions, development and acquisition of Army and joint space systems.[30]

USASA and USASI were both formed to implement and integrate Army space doctrine. Army Space doctrine is found in <u>Army Space Operations, Interim Operational Concept (U)</u>, August 1985, classified SECRET. The operational concepts espoused envision Army combat operations not limited to the land, sea, and air, but rather linked to space as the fourth operational medium.[31] Space doctrine attempts to maximize support for the ground commander and reflects the operational level of war. It talks about the fundamental decision of when and where to fight and whether to accept or decline battle. Additionally, it envisions operational level integration of space and ground operations.

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[29] <u>Commander's Handbook of Space Systems for Support of Army Forces</u>, (Peterson AFB, Co., 12Mar87), p.13.

[30] Ibid.

[31] <u>Army Space Operations Interim Operational Concept (U)</u>, (August 1985), p 7.

The enhanced observation and communication capabilities afforded by space systems, combined with data processing and transfer, provide operational level commanders with timely, reliable information necessary to support the decision cycle and responsive communications to facilitate the execution of land campaigns. The full use of space assets supports the concentration of superior combat power at the decisive time and place. As space systems most directly augment planning, execution, and support of major land campaigns, the command and control of these assets is executed primarily at the operational level.[32]

Space support operations are divided into two categories: **force application** against ground and aerospace targets and **force enhancement** which involves the use of space systems to improve the effectiveness of functions performed principally by terrestrial forces.[33] Details of the systems that space support operations encompass will be discussed in Chapter Five, Space Support Operations.

Army space integration currently occurs at the Unified Command, Army agency, and Institute at MACOM level. However, at the operational and tactical levels, no staff proponent exists with doctrinal responsibility for space coordination or integration. Thus, headquarters planning operational maneuver must currently go directly to the MACOM for space support, since they have no single organizational element responsible for space integration. This situation has both advantages and disadvantages. The examination of operational maneuver in the next chapter and space system integration in chapter six provides insights as to whether the current situation is as bad as it seems and/or needs to be changed.

IV. Operational Maneuver

[32] Ibid., p.9.

[33] Ibid., pp.3,4

Operational maneuver provides a means to link the strategic objective to the tactical battle. Successful operational maneuver can so threaten the enemy that his plans are upset to such a degree that he must react, shift major forces, and weaken his operations elsewhere. The result is a general unhinging of his whole war effort.

Operational maneuver has three distinct phases: planning, deployment, and employment. The requirements for each phase may differ but space support operations can enhance each phase. A matrix that integrates operational maneuver factors, phases, and space support is shown at Figure 2.

The planning phase is first and most critical. This phase evaluates the current situation, evaluates the strategic objective, assesses the political objective, determines the enemy centers of gravity, and then determines what actions, if undertaken, will be major steps on the road to campaign success. When developing an operational maneuver concept, the operational or strategic commander must consider the means and methods he has available as well as the ends he intends to achieve. He must answer the questions "Will the maneuver achieve a major strategic objective that leads to campaign success? Can a major enemy center of gravity be struck, directly or indirectly?" After determining the objective of the operational maneuver, planning continues and determines the details of accomplishing the mission.

Detailed operational and mission analysis tailors the force to the mission and fine tunes the force requirements based on wargaming of both the operational maneuver and the tactical battle that would follow. Joint planning becomes essential. The Intelligence and Tactical Analysis provides necessary details through the threat assessment and intelligence preparation of the battlefield (IPB). Security, protection, and deception requirements are identified. Keeping the enemy off balance may allow the operational maneuver to achieve success. Resource requirements, transportation for deployment and employment , casualty evacuation, resupply, host nation support, maintenance, and recovery all must be planned in detail. The command and control structure must be established with the unit in charge designated and brought into the planning effort. Communications systems and procedures must be prepared. Throughout all of the planning the principles of war must be reviewed and incorporated as appropriate. The joint nature of operational maneuver should be kept in mind throughout all its phases. A detailed list that identifies elements to be considered is found at Table 1, as mentioned earlier.

Thus the enemy center of gravity and the mission are closely related and interwoven. At the operational level it may be possible to strike either a political or military center of gravity. If an alliance or civilian center such as a capital is a strategic center of gravity and can be threatened, the result may be the fracture and destruction of the alliance or national will. If the operational center of gravity is not the force itself but a logistical center or command and control capability, the force requirements may be fewer and of a different type. By determining the centers of gravity at both the operational and strategic level, it may be possible by moving large forces into position to strike them directly.

The operational maneuver mission to strike directly or indirectly at the center of gravity results in either an offensive or defensive mission. Selection of appropriate mission objectives, the type of execution required, forces to be employed, terrain to be traversed, and enemy to be fought establish the nature of the operational maneuver.

Troop requirements become dependent on the mission and the center of gravity to be attacked. Each force type (light infantry, airborne, airmobile, mechanized or armored) is tailored to engage specific kinds of forces and accomplish only certain missions. As specific type troops are selected, force mobility becomes an issue. The force selected must be capable of generating sufficient combat power to accomplish the mission while retaining adequate mobility.

Force mobility at the operational level is the ability to move large combat formations to accomplish operational level maneuvers over large distances within a theater[34].

> ...Maneuver on interior lines or redeployment between sectors requires tactically mobile forces--armor, motorized, helicopterborne, foot--depending on the terrain at issue. Maneuver on exterior lines requires strategically mobile forces-- marine, airborne, light infantry-- depending on the nature of the operation to be conducted.
>
> One of the characteristics of operational maneuver is the complementary use of differing type forces.[35]

Inherent in this is the challenge of arriving at the designated place and time prepared and capable of performing the required mission. An example of operational maneuver and use of complementary forces in a combined operation is readily found in the Korean War examples.

Intelligence and tactical analysis must be accurate, timely, and in a form useful to the commander. "The entire intelligence gathering, analysis, and dissemination process must be geared to provide the commanders, at as many levels as possible, information upon which to make decisions."[36] Identification of enemy forces, intentions, routes, obstacles, weather, and key terrain are all essential elements of information. Intelligence preparation of the battlefield is enhanced with timely and accurate satellite imagery and collection efforts.

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[34] Col Huba Wass De Czege, Understanding and Developing Combat Power, (Ft. Leavenworth, Ks., February 1984), pp.22-25.

[35] Toth, p. 67.

[36] Wass De Czege, p.23.

Security and deception efforts deny the enemy information about friendly units; security measures degrade his acquisition capability, and speed of operations deceive the enemy as to intentions and capabilities. Space systems will allow us to view the visual and electronic signatures of various units and then replicate them for deception purposes while at the same time changing and moving the actual units. Headquarters can be made to look like low value targets to deceive the enemy.

The Command, Control and Subordinate Systems architecture is being created to enhance C^3I on the modern battlefield. Joint Tactical Information Distribution System (JTIDS) and Position Location Reporting System (PLRS) [37] and the Maneuver Control System (MCS)[38] are all designed to enable the operational commander to use his forces better. Communications support the rapid, timely flow of information and orders necessary for effective command and control. Reliable, redundant communications use and depend on high technology systems. Integration of satellites improves on line of site through the relay in the sky. As distances increase, extended use of satellite communications will keep the maneuver force in immediate contact with the controlling headquarters. Integration of space systems is already being accomplished in the C^3I areas.

Management of resources includes resupply, movement and maintenance of equipment, supplies, personnel, and time.[39] Operational sustainment becomes a critical factor. Lines of communication must be evaluated, forward staging bases selected, and resource consumption, resupply rates and methods

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[37]CPT Gary Phelps, "Hybrid Digital Data Distribution System" The Army Communicator, (Winter 1980), pp. 28,29.

[38]Col Alan B. Salisbury, "MCS: The Maneuver Control System". Signal, (March 1982), pp. 35-39.

[39]Wass De Czege, p. 24.

and protection of resources all have to be considered. Management of resources and time requires effective communications and reporting systems

Principles of war are often overlooked as only general guidelines with no direct application. At the operational level and in particular when applied to operational maneuver, they become almost prescriptive in nature. Objective, Offensive, Mass, Economy of Force, Maneuver, Unity of Command, Security, Surprise and Simplicity all must be applied when planning and executing an operational maneuver. They are mentioned separately here only because they tend to be overlooked. However, they have been integrated into Table 1 and should be actively considered during each phase of the operation.

Operational maneuver is a complex integration of vision, risk, and strategic, operational, and tactical capabilities. The results set the preconditions for tactical success and should lead to a strategic decision.

Space support can have a major impact on the operational maneuver. The next chapter examines space support operations and the capabilities of potential systems that have obvious importance to mission success.

V. Space Support Operations

Army space doctrine specifies that space assets support the ground commander. Space systems support is directed in the following areas: control from space, support from space, force application, force enhancement, and technology spin-offs from space. Development of hardware and systems to incorporate the above areas is underway. Because of the inherent vulnerabilities of space systems, the systems designed to support each of these areas need a redundancy that is not necessarily based in space.

Control from space endeavors to enhance the operational commander's ability to command and control his force. Work is ongoing to create a Command, Control, and Subordinate System (CCS^2) that includes the personnel, equipment and procedures to direct and coordinate the integrated battlefield. The CCS^2 will integrate the five distinct battlefield functions of maneuver, fire support, air defense, intelligence and electronic warfare, and combat service support. The CCS^2 is being designed to integrate the battlefield and provide a synchronization of effort that previously has been unattainable. Space systems support the CCS^2 by providing enhanced communications, information processing and exchange, surveillance, target acquisition, terrain and weather data, identification of enemy movement and assembly areas, and a myriad of other capabilities that directly support the five battlefield functions.[40]

Support from space involves operations that support systems in space as well as operations by space systems that support terrestrial forces. Systems which support terrestrial and ground commanders are further divided into force application and force enhancement.

Force application from space is the engagement of terrestrial or aerospace targets to include enemy ground assets, aircraft and space systems by weapons on space platforms. As space based force application systems develop, they will provide a credible space artillery, direct fire capability against high priority targets. These targets may include tactical missile defense, aerospace vehicles (airplanes and helicopters), air defense systems, critical transportation nodes, command and control centers, critical units, and possibly even key individuals.

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[40] Army Space Operations, pp.A-2-A-4.

Force enhancement incorporates combat support operations involving the use of space systems that improve the effectiveness of functions performed principally by terrestrial forces.[41] Force enhancement operations encompass a variety of operations some of which are listed below:

-Communications (to include data processing and transfer)
-Terrestrial surveillance (to include tactical warning and meteorology)
-space surveillance
-navigation and positioning (to include Global Positioning System)
-weather monitoring
-mapping, charting and geodesy
-search and rescue aids
-target acquisition and designation
-minefield detection
-barrier detection
-deception negation.[42]

Current unclassified systems have at least some capability to do all of the above except the last four. Potential space uses through the far term have been identified and are listed in Table 2. The potential capabilities are both new and expansions of current systems. Future systems plan to meet the doctrinal force enhancement operations shown above.

Intelligence gathering is one of the most important functions accomplished from space and includes collection of electronic intelligence (ELINT), imagery intelligence (IMINT), signals intelligence (SIGINT), direct communications with human intelligence sources (HUMINT), and communications intelligence (COMINT). Discussions of US intelligence collection capabilities are very sensitive, closely protected and will not be addressed. The following paragraphs briefly highlight each of the force enhancement operations.

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[41] Ibid., pp. 3, 4.

[42] Ibid., p. 12.

Current satellite communications capability are close to capacity as DOD leases commercial systems and circuits to meet the demand. The CCS^2 system depends on a high capacity, high performance communications/data transfer capability. Expansion of the communications capability should be first priority. The Military Satellite Communications System (Milstar) is the next generation communication satellite that will increase our capability and support both operational and tactical users. All U.S. command and control systems to include the World Wide Military Command and Control System (WWMCCS) and the Joint Operations Planning System (JOPS) depend on real-time, secure, redundant, and resilient communications capabilities.

Surveillance systems continue to improve. What started as a ballistic missile and arms control verification capability has expanded considerably. Reconnaissance satellites take pictures of objects on the earth or in space and then relay those pictures to ground-based receiver stations. Early relay systems started as film canisters ejected from satellites and recovered by aircraft. Systems now can either eject film cannisters or electronically down-link data, television pictures, radar images, infrared, and other optical or electronic signals, as they are collected.

The desire to see smaller objects and more details has resulted in the definition of resolution requirements to meet specific demands for information. The amount of detail required to identify and classify objects increases as requirements progress from simple detection to technical intelligence. Resolution requirements occur over the following scale and are used in Table 3:

Detection	Identification General & Precise	Description	Technical Intelligence
Least Resolution		----->	Highest Resolution

In general terms this scale relates to the ability to identify and assess accurately objects, components, their size, and structure. A simple example is observing a tank a mile away, detection. With a pair of binoculars it is possible to tell general identification, friend or foe, and maybe even precise identification as to type, M60, M1, T54, or T62. More powerful magnification enables a detailed description and with very powerful optics the ability to gather technical intelligence such as size, location, composition, and function of components. Table 3 identifies specific resolution requirements to meet recognized surveillance needs.

Navigation and positioning are essential elements of operational maneuver. Forces can be required to move long distances over poorly charted terrain. The Global Positioning System (GPS) satellites will provide users the ability to locate themselves in three dimensions (coordinates and altitude), to within 10 meters, anywhere on the earth. GPS also measures and provides information on velocity to .1 meters/second and time to .1 microsecond. This capability will allow better control and more precise locations, prevent units and people from getting lost and will be available in manpack form.[43] Knowing precise locations allows units to mass either themselves or the fires of supporting units. Instant knowledge of a unit's precise location has great potential for all units - combat, combat support, and combat service support.

Weather monitoring is currently accomplished by three satellite systems - Defense Meteorological Satellite Program (DMSP), Geostationary Operational Environmental Satellite (GOES), and Television Infrared Observation Satellite/ National Oceanic and Atmospheric Administration (TIROS-N). All the systems provide information to the Air Force Global Weather Central, Offut AFB, NE.,

[43] Commander's Handbook of Space Systems, p 1

where it is combined/processed and distributed to the Army via the Staff Weather Officer and Weather Service Detachments at Army Airfields. Seven tactical terminals world-wide can receive hard copy of real time visual and infrared cloud cover as the DMSP satellite passes overhead. However, this system does not provide the information needed by Army aviation concerning cloud bases, low-level winds, wind profiles, and visibility or the ground maneuver requirements for soil conditions, trafficability, snow depths, soil moisture and the other environmental factors that affect operational maneuver. In spite of the current limitations the Army has not yet decided to develop its own environmental satellite to satisfy its meteorological data requirements.[44]

Accurate forecast and real time environmental information can be invaluable to an operational planner who must consider what support is required, particularly aviation and visibility requirements for direct fire weapon systems. Are roads and fields trafficable? Will rivers be at flood stage? Meteorological conditions must be forecast as well as other weather related questions that must be answered world-wide. It was adverse weather that grounded Allied aviation during the German counter-attack in the Battle of the Bulge. Likewise, it was knowledge of a break in the storm system that allowed Eisenhower to attempt the landings at Normandy on June 6, 1944. And it was unforecasted sand storms that adversely affected the Iran hostage rescue operation. Weather conditions that affect mobility, concealment, and air support should be exploited whenever possible since weather and terrain affect combat more significantly than any other factor.[45]

Mapping, charting and geodesy are currently handled by the Defense Mapping Agency (DMA) using LANDSAT and aerospace vehicle photography. DMA

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[44]Ibid., pp.9,10,12.

[45]FM 100-5, pp.24,75,76,121.

does not provide real-time or near real-time support. Knowing where you are, where you're going, the routes you're going to use to get there, and what the objective and points in-between look like are essential to any operational maneuver. Satellite imagery and digitized terrain information that support cruise missile systems could also be used to provide updated ground information as well as map supplements.

US search and rescue satellites were not in orbit until long after the United States started using Soviet satellite search and rescue data to locate downed aircraft. Since then progress has been made and the US now has its own capability. In peacetime the United States and the Soviet Union share the search and rescue satellite systems. In wartime this capability is essential to locating downed aircraft and surviving crew members particularly when operating over hostile territory and at great distances from friendly terrain.

Target acquisition and designation satellite systems are classified. However, the technical capability exists to provide video and locational targeting data to missile weapon systems. This capability is not incorporated into Army weapons, but could be. Near real-time digital data is provided to cruise missile targeting personnel. This data could also support ground maneuver and attack of specific targets that may critically impact on operational maneuver.[46] Control of RPVs and other ground sensory devices could be space based.

Minefield and barrier detection requirements have been identified in Table 3. For this type information to be of use to operational planners and executing units, it must be real or near real-time information. Task organizations and locations of certain units (ie. engineers) in a movement order

[46] Eugene Kozicharow, "Navy Developing Rapid Strike Planning". Aviation Week and Space Technology. (July 6, 1984), pp.49-54.

can be changed depending on known obstacles and minefields on the route of march and at the objective. The importance of accurate minfield and obstacle data is self-evident.

Deception negation requires complex collection and interpretation to identify the enemy's real plans and see through complex deception schemes. Satellites can also aid our deception efforts. By collecting data on how our units appear to threat sensors we can then duplicate their signatures with lesser value units at locations that support our deception schemes. The Egyptians, prior to the 1973 war, took measures to hide critical assets from satellite surveillance systems and conducted other actions in full view in an attempt to further their deception plan.[47]

Potential space uses and capabilities have been identified and projected through the far term, the year 2025. These uses are listed at Table 2. The systems identified directly support the doctrinal requirements of force application and force enhancement. In fact, many of the potential uses exceed the doctrinal guidance. New organizations from divisions to corps can be structured around the emerging space capabilities. In fact some work has been done to provide the basic structure of a corps that fully utilizes space systems. This new organization requires significantly reduced equipment and manpower while actually increasing the number of fighters.[48] Given the availability of these systems, it is imperative to integrate them into operational maneuver and AirLand Battle Doctrine. The next chapter provides a framework and methodology to integrate the space support capabilities.

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[47] Shazly, p. 199.

[48] LTC Theodore T. Sendak, Army Role in Space: Design of an Army Corps Incorporating Space Capabilities. (Carlisle Barracks, US Army War College, May 1986) p. ix.

VI. Integration of Operational Maneuver and Space

One of our Army's current shortcomings is a failure to develop the organizations that execute AirLand Battle doctrine in a manner that integrates space doctrine and space enhancement operations into operational maneuver. The current system is cumbersome, slow, and non-responsive. What is needed is a structure that takes advantage of the potential and overcomes the weaknesses of our current system.

That problems existed in understanding, grasping, using, and employing new capabilities was clearly recognized during the fielding of the tactical systems MLRS and M1 tank. These systems were not just improved artillery or a better M60, but they provided completely new capabilities that had to be integrated, over time, with extensive training and modification of doctrine and tactics. Problems arose because the organizations didn't recognize or incorporate the new capabilities into their concepts of employment. For the same reasons, the inability to integrate projected space support systems into operational maneuver does not lie with the specific systems or their capabilities but rather is a doctrinal, organizational and structural problem.

Disseminating knowledge of enhanced capabilities is only one part of the problem. If the operational planner knows that he can find out details of the enemy troop disposition, terrain forms, weather, obstacles, road and rail nets, bridges and choke points, command and control organizations and structure and the information to locate and identify centers of gravity , he will certainly ask for the information. Specific planning requirements once identified can be requested and, if available, integrated in a timely manner. As force enhancement capabilities improve, they will be used if known and readily available to the user.

There are at least five ways organizationally and structurally to integrate space systems into operational maneuver: 1) Centralize control, planning, and access to space at the highest levels. 2) Decentralize and create space elements on Divisions and higher staffs to collect, coordinate, request and integrated space system support. 3) Decentralize and with additional training incorporate space systems into existing functional areas. 4) Build the space systems and interfaces into the hardware so space access is "transparent" to the user. 5) Combinations of the above.

Currently access to space systems is centralized at the highest level, the Unified Command, USSPACECOM. USSPACECOM coordinates and consolidates all space related requirements of Unified and Specified (U&S) commands. Likewise, the US Army Space Agency (USASA) coordinates Army requirements with the US Army Space Institute (USASI) and DA/ODCSOPS. USASA also solicits requirements and request for support directly from the Army components. "To summarize, for the Army there are two separate processes for developing space requirements - one joint and one Army peculiar."[49] In addition to the current system of centralized requirements planning, access to all systems is also centralized and controlled at the highest levels.

Communication systems have channel capacities allocated to Unified and Specified CINCs by the JCS. The CINCs apportion channels in accordance with their users' needs. But the tactical users must have JCS validation for satellite access.[50]

Likewise, meteorological data and terrain information are collected and managed by other than Army assets at the highest levels and are not always responsive to operational needs.

[49] Commander's Handbook of Space Systems, p.14.

[50] Ibid., pp.2-4.

Intelligence and imagery requests are prioritized at U&S command level and forwarded to JCS and/or DIA for action. Depending on the product, it may come directly to the Corps All Source Information Center (ASIC) or be filtered at a higher level.

One advantage sought in space systems is rapid, timely, and accurate information. The current centralized control of space systems tends to slow and degrade responsiveness. Centralized control creates a bottleneck that prevents timely space support. Routine use, from idea to request, to product receipt is very time consuming. Given a system that is slow in peacetime, little thought is given to using space systems when time is critical. Information received too late is of little or no value. If space systems are ever to be fully incorporated at corps or division, the problems of timely response must be corrected. Prioritization is not the answer for just as in peace when most requirements are routine, in war they all become priority or immediate.

Decentralization of control with the addition of a space element on the staff to collect, coordinate requests and integrate space requirements is a solution. Creation of a special staff position called Assistant Chief of Staff Space (ACS Space) to work at division and higher levels puts a focus on space at the tactical and operational level that is needed. This system has some benefits but unfortunately it requires additional staffing during a time of personnel austerity. Additionally, if the centralized request procedures are still in effect this solution provides one more bottleneck that restricts and slows timely integration of space support.

Decentralization with additional personnel training and the incorporation of responsibility for space systems into existing functional areas may be the most appropriate way to integrate space into the tactical and operational headquarters. The USACGSC curriculum starting in FY 87 includes an elective titled "Space Operations". This is the first step in an educational process that can incorporate space into Army operational maneuver staffs. Space training at the field grade officer level will initially keep planning and integration at a level where operational coordination occurs. Training staffs to integrate space systems will cause more involvement and thus more use. As commanders and staffs learn more about the emerging technologies and space solutions to their problems, integration of space will become more natural. Integration into operational maneuver of those space systems identified at Table 4 will occur naturally if each staff is trained and responsible for its integration.

Building the space interface directly into the hardware component is the simplest method as far as the user is required. Direct access by all users to space systems allows every operational planner to enjoy the most timely and responsive support possible. Individual systems like the Global Positioning System allow each user to access space systems in a "transparent" mode. The user doesn't know or care how he gets the data, only that it is timely and accurate. Building space into each system provides the optimum of flexibility and user access. This approach is easiest with systems that provide the user a visual or auditory product, such as communications, surveillance, force applications, targeting, RPVs, weather monitoring, etc.

However, there are problems with this approach. All systems don't lend themselves to direct space access. At the tactical level the physical volume of requests and data flow may be impossible to handle. Direct access to all the systems at Table 2 may be appropriate only at the operational level.

The combination approach to integrating space into operational planning and execution appears to be the "best" method. The strengths of centralization for long range capability and requirement planning, decentralization for training, and utilization of "transparent" systems at the user level truly integrate space into operations at all levels. Making functional staff elements responsible to plan and integrate space will work if they are trained and have ready access to the systems and products. Creation of a separate space staff at the tactical and operational level would only tend to separate space systems from the operations when what in fact is wanted is integration. A separate staff also creates an additional bureaucratic bottleneck for support. Thus a distinct space staff at division or corps is probably the least desirable method of space integration.

Space enhancement of operational maneuver is possible. However, space must be integrated into the total force structure and enhance all operations. Support for a single function such as operational maneuver is not effective and probably not possible without building a system that supports the total operational force.

If space systems are not integrated at the joint, operational, and tactical level, we will continue to be victim of foul-ups and system short-sightedness such as occurred in Grenada when the force had to use tourist maps to navigate, couldn't communicate between services headquarters, had trouble with routine coordination, and couldn't respond to requests for fire support. That systemic problems existed is also evident when the division commander happens upon the only soldier who knew what was arriving on the next airplane. That one soldier was at the arrival airfield with the only direct communication to Green Ramp and the departure airfield at Fort Bragg. Problems of this nature arise when systems are centralized and in scarce supply. For space to be functional, it must be integrated into each staff section and in enough quantity to be useful.

Can we use and take advantage of what has been developed? Yes, but there are problems that we must overcome. 1. The centralized structure that currently exists restricts integration of space capabilities into operational maneuver and almost prohibits its integration into tactical and general use. 2. Many systems and products are classified Top Secret, compartmentalized, with restricted access and distribution which limits their availability, application, and utility. 3. Current systems are costly and low density, again limiting availability. 4. Intelligence and imagery request and prioritization procedures limit timely support in peace time. It will only get worse in war. 5. Doctrinally, we've said space will support the ground commander; organizationally the equipment, training and responsibilities have not been created to provide and integrate that support. Currently, space is seldom considered operationally. Consideration is given to the few products collected at the national level and passed to the operational level commander on request, to his All Source Intelligence Center (ASIC). These products go to corps level, rarely on time, and almost never below corps. One proposal to fill the void in integration of space would be creation of a Fusion Exploitation Center (FEC) to integrate space, air, and ground operations.[51] This proposal was made in a 1986 War College Study; however, before creation of a FEC, other alternatives should be explored. One alternative would be to use the Battlefield Coordination Element (BCE) currently under development.

The combination approach identified above may be the most efficient by reducing the turmoil associated with fielding new systems, yet retaining the existing organizations and only incorporating responsibility for space into their areas. Creating new staffs is a traditional solution to problem solving but is not always the most effective.

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[51] Sendak, p.26.

Actions can be taken to correct parts of the previously identified problems. Partial solutions should include relaxing security classifications on many products, making products available for training, simplifying the request procedures, and making timely product availability a priority Integration of space products into CPXs, MAPEXs, and FTXs will increase awareness. Additional training for staffs and commanders is necessary before we can hold staffs responsible for space integration. It is necessary to increase demands on the Army, DOD, and National sytems to force a needed response. Without the operational and tactical level demands from the field, product and procedural changes will not occur in a timely manner. Integration of space must occur by changing both the organizational systems and expectations at every level.

VII. Conclusion

> Superiority in weapons stems not only from a selection of the best ideas from advancing technology but also from a system which relates the ideas selected with a doctrine or concept of their tactical or strategic application...It has probably more often happened that ...their full potential value has remained unexploited because higher policy-making echelons have failed to modify prevailing doctrine to embrace the innovation. New weapons when not accompanied by correspondingly new adjustments in doctrine are just so many external accretions on the body of an army.
>
> I.B. Holley Jr. (1971)[52]

It is apparent that space systems can support operational maneuver The doctrinal requirements to provide space enhancement in the following areas can be accomplished and will support operational maneuver.

-Communications (to include data processing and transfer)
-Terrestrial surveillance (to include tactical warning and meteorology)
-space surveillance

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[52]Holley, p. 14.

-navigation and positioning (to include Global Positioning System)
-weather monitoring
-mapping, charting and geodesy
-search and rescue aids
-target acquisition and designation
-minefield detection
-barrier detection
-deception negation.[53]

Table 2 identifies space capabilities that can be available between now and the year 2025. How these capabilities will be integrated to support not only operational maneuver but the Army force structure as a whole becomes the relevant question. The current centralized system will not support operational maneuver in a timely fashion if we intend to adhere to our doctrine of Air Land Battle and its tenets of Initiative, Agility, Depth, and Synchronization.

Space systems will grow from their current capabilities of communications, observation, intelligence collection, position locating, and search and rescue to ones that support the enhanced CCS[2] architecture. Integration of the Maneuver Battlefield Systems, Fire Support Battlefield Systems, Intel/EX Battlefield Systems, CSS Battlefield Systems, and Air Defense Battlefield Systems will be a monumental task that only the advanced technology of space systems can credibly handle. Space systems add a new capability to the operational commander that enhances his ability to perform operational maneuver. For the commander to realize these advanced capabilities a number of changes must occur.

To receive the maximum benefit from space systems, the current space architecture must be **decentralized**. Centralized control while providing equitable distribution of assets throughout the force does not support

[53] Army Space Operations, Interim Operational Concept (U), p. 12.

decentralized operations and operational maneuver. Space systems must be integrated and responsive in training if they are going to be used in war.

Request procedures must ensure **timely and responsive suppport** to the user in peacetime if we expect him to use them in wartime.. The current procedures are a bottleneck that must be reexamined.

Declassification of space products is necessary. A number of authoritative publications are now coming in print that expose many of the closely held space system capabilities. Those maneuver forces in the Army that benefit from space systems should have access to the products commensurate with their mission responsibilities. Currently, it seems that only planners at the TOP SECRET level have that access and they won't be the ones on the ground executing anything.

System designs such as the Global Positioning System that make space "transparent" to the user should be incorporated as much as possible or economically feasible. Space system "**transparency**" is the ultimate integration of space support systems. New communication systems can integrate this approach and make secure wrist transceivers and video monitors a reality.

Training on space systems and their integration into the tactical and operational level is important. The Army should not plan on training only a "selected few" space system experts but rather expand and integrate space training to the service schools so the officer corps in general is aware of and can properly use and integrate space systems.

Integration of operational maneuver and space systems cannot be done in a vacuum. Space systems are becoming so pervasive that their effects are felt in every area. Therefore, integration must extend beyond operational maneuver and include the total force. A total force enhancement will ensure space provides those selected capabilities that improve operational maneuver planning and execution.

Applying space system support to operational maneuver requires thought, imagination, and vision. It is still necessary to ask the right questions to get the appropriate answers. Space doctrine currently provides the right direction toward integrating space systems and operational maneuver. It is our challenge to improve and implement that doctrine.

FIGURE 1

VIEW FROM SPACE

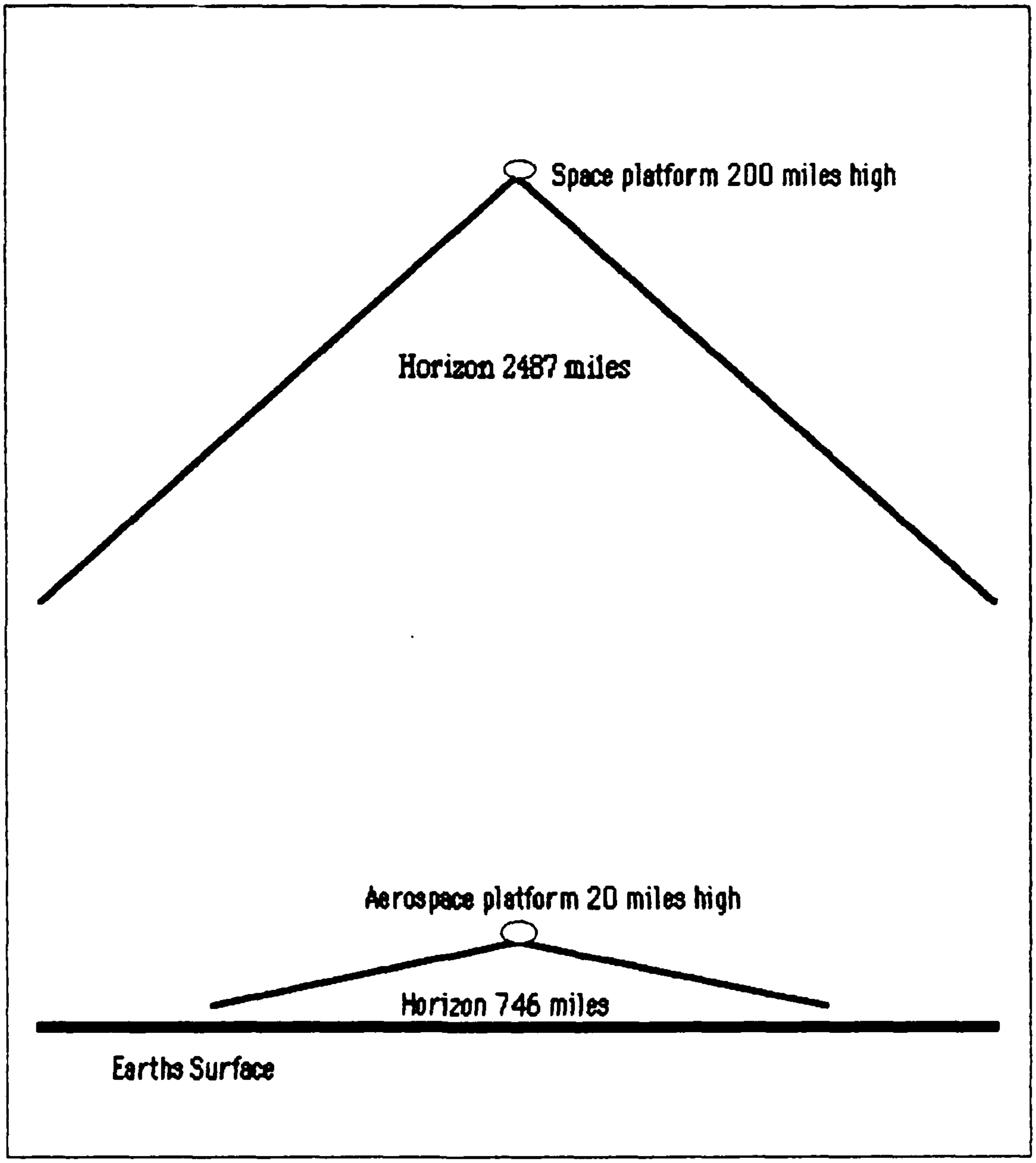

FIGURE 2

OPERATIONAL MANEUVER PHASES SUPPORTED BY SPACE SYSTEMS

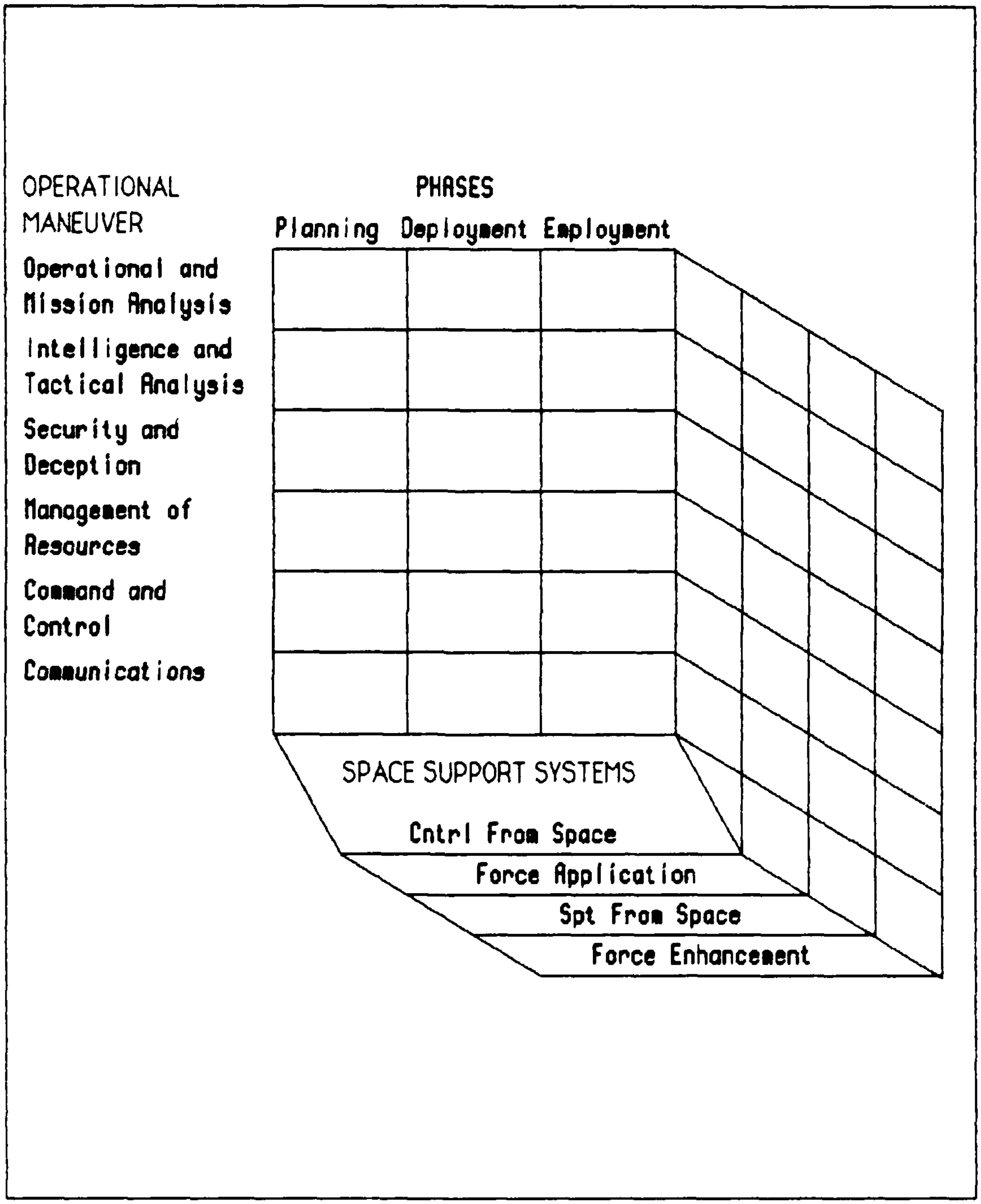

FIGURE 3

TIME PHASED SPACE SUPPORT

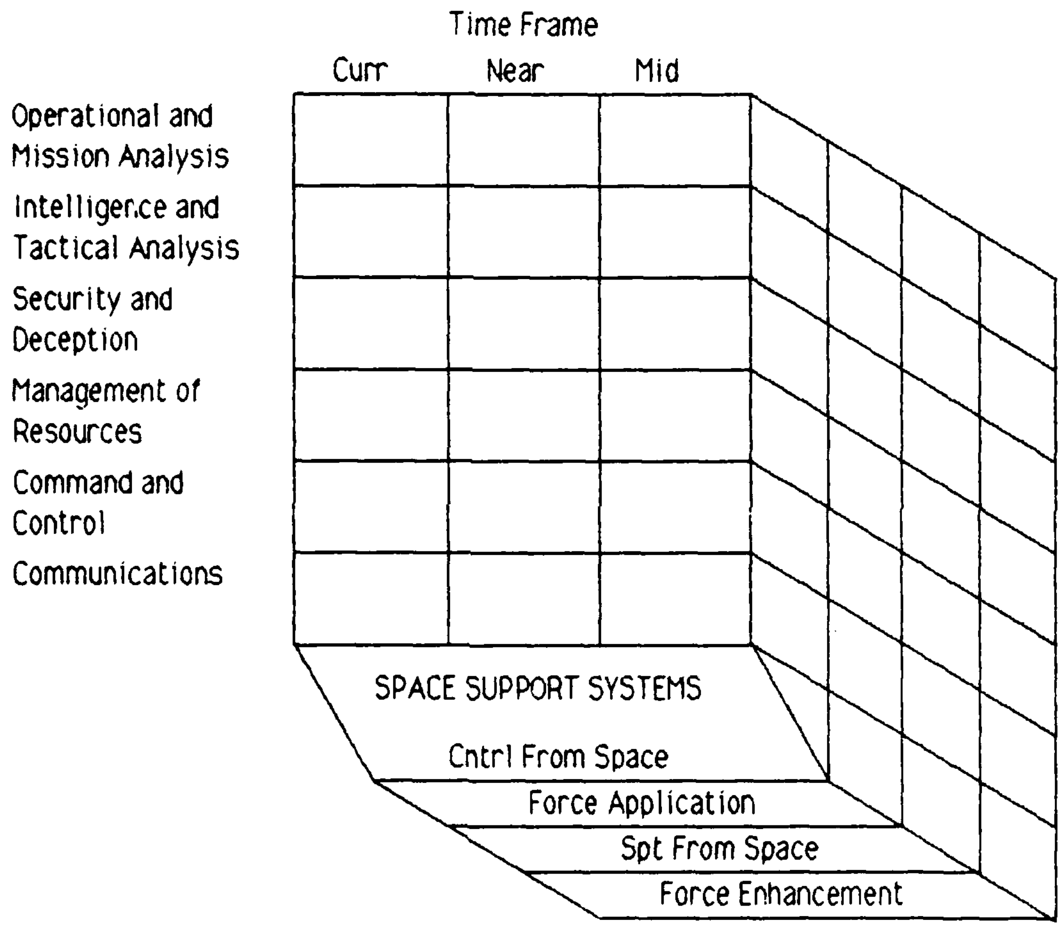

TABLE 1

CONSOLIDATED FACTORS AFFECTING OPERATIONAL MANEUVER

I. Operational and Mission Analysis
    A. Political Objectives
    B. Center of Gravity
    C. Mission
        1. Strategic Objectives
        2. Intent
        3. Offensive or Defensive
        4. Doctrinal Forms of Maneuver
        5. Operational Interference, Interdiction
        6. Positioning to Threaten Multiple Forces
        7. Maneuver - Positional, Massing of Forces
        8. Disruption of Enemy Maneuver
        9. Simplicity
    D. Force Mobility
    E. Mass
        1. Combat Power Generation
        2. Economy of Force
    F. Surprise
    G. Troops
        1. Force Requirement - Complementary Size & Types
        2. Deployment & Redeployment
        3. Reserves
        4. AirForce Support
        5. Naval Support
        6. Allied and Host Nation Support
        7. Moral Factors
    H. Time Available
        1. Time to Plan & Organize, Communicate, Prepare, Move and Execute
II. Intelligence and Tactical Analysis
    A. Enemy
        1. Intelligence Estimate
        2. Surveillance
        3. Ability to Locate and Track Enemy Forces
    B. Terrain and Weather
        1. Intelligence Preparation of the Battlefield
        2. Key and Decisive Terrain
        3. Lines of Communication

4. Environment of Combat
5. Weather and Visibility
6. Current Terrain Intelligence

C. Obstacles & Barriers

III. Security and Deception

A. Protection
B. Surprise
C. Simplicity

IV. Command and Control

A. Unity of Command
B. Ability to Integrate Forces and Resources
C. Ability to locate and Track Friendly Forces
1. Flexibility
D. Air Dimension: Organization, Control and Operations
E. Ability to Fuse Technology
1. Responsive
2. Redundant

V. Communications

A. Flexibility
B. Redundancy
C. Security

VI. Management of Resources

A. Support Available
1. Combat Support
2. Combat Service Support
3. Sustainment
B. Lines of Communication
C. Forward Staging Bases and Expansion of LOCs

Identification of any subelement is accomplished by listing the category and subelement, ie. VIA2 identifies Combat Service Support within the sub-category Support Available within the general category Management of Resources.

Source: Extracted from FM 100-5, Operations, May 1986; James E. Toth, Higher Direction of Military Action ,(Second Draft). July 1986; and Army Space Operations, Interim Operational Concept (U), August 1985.

TABLE 2

POTENTIAL SPACE USES

Potential Space Uses	Capability Available in Term Near	Mid	Far
Close Combat Light (CCL)			
Navigation-			
--World Wide Common Grid		X	
Combat Wrist Watch-			
--Standard Date/Time Group	X		
--Commo Transceiver		X	
--Position/Location/Navigation	X		
--Chemical Detection		X	
--Radiation Dosimeter		X	
--Calculator/Stop Watch/Alarm	X		
--TV Picture of What is Over the Hill			X
--Secure Capability		X	
--Owner/Address Codes	X		
Fire Support			
Space artillery against airborne and ground targets			
--Laser (free electron, microwave, chemical)		X	
--Hypervelocity Projectiles			
----Electromagnetic Accelerator (rail gun)		X	
----Chemical Propulsion	X		
--Robotic, Satellite Controlled Artillery Batteries.		X	
Position Survey and Location		X	
Fire Adjustment			X
--Weapon Guidance		X	
--Target Designation (Location)		X	
--Artillery Adjustment		X	
--Guide Manned/Unmanned Delivery Means	X		
Target Acquisition			
--From Low Altitude		X	
--From Geosynchronous Orbit		X	

--Identification of Enemy from Friendly (IFF)		X	
--Remote Targeting Processing Centers		X	
Meteorological and Terrain Data (See IEW)			
Air Defense (ADA)			
IFF			
--Active	X		
--Passive		X	
Knockdown Capability from Space		X	
ASAT		X	
Tactical Missile			
--Detection	X		
--Knockdown from Space			X
Realtime Target Acquisition		X	
Integrated Battle Management of All			
Air Defense Systems		X	
Communications (COM)			
Command Center (Post)			
--Divisions and Above (High Volume)	X		
--All Levels (High Volume)		X	
--Covert Laser Communication Support		X	
Smart Satellite Switchboards		X	
High Speed Communications Crosslinks			
Between Satellites and Laser Communications Relay		X	
Ground to Ground			
--Wrist Radio Receivers	X		
--Wrist Radio Transceivers		X	
Ground to Air			
--NOE Communications for Aviation		X	
Air to Air	X		
Command and Control (CC)			
Staff Operations			
--Information Gathering	X		
--Analysis	X		
--Decision Making Assistance	X		

--Information Dissemination	X		
--Video Staff Conferences	X		
----Holographic Images of Dispersed Conferees		X	
Fusion Center Ground Links, Fiber Optic			
--90 Mbps	X		
--300 Mbps		X	
--Surface Fusion/Exploitation Center Construction	X		
--Space Fusion/Exploitation Center Construction		X	
--Moon Fusion/Exploitation Center Construction			X
--Mobile Satellite Control Facilities		X	
Wide Band Satellite Communications			
--300 Mbps (TDRS)	X		
--Multi Gbps		X	
Intelligence and Electronic Warfare (IEW)			
Reconnaissance/Surveillance			
--Weather Monitoring	X		
----Cloud Cover	X		
----Winds	X		
----Ice and Snow Cover	X		
----Precipitation/Rate	X		
----Temperature	X		
----Barometric Pressure			X
----Fog	X		
----Humidity	X		
----Three Dimensional Realtime Display of Weather		X	
----Solar Emissions	X		
--Force Monitoring (Friendly and Enemy) Detect and Locate			
----Corps Capability	X		
----Division/Brigade Capability	X		
----Platoon Capability		X	
--Identify and Track Forces			
----Corps Capability	X		
----Division/Brigade Capability		X	
----Below Brigade			X
--Determine Trafficability, River Crossing Sites, Fording Sites, Intervisibility, Cover and Concealment		X	
--Battle Damage Assessment	X		

--Alert to Enemy Reconnaissance Efforts		X	
--Minefield Detection		X	
--Barrier Detection		X	
--Surveillance of Rear Area, LOCs and Fac	X		
--Detection and Monitoring of NBC Use by Enemy or Friendly Forces		X	
--Target Acquisition		X	
--Target Cueing		X	
--Location of Drug Crops	X		
--Automatic Terrain Analysis		X	
--Space/Sensor Border Surveillance		X	
Intelligence Preparation of the Battlefield Integrating Above Factors	X		
Combat Support, Engineer and Mine Warfare (EMW)			
Mapping, Charting, and Geodesy	X		
Minefield and Barrier Employment/Clearing			X
Minefield and Barrier Breaching Through Space Controlled Robotics		X	
Minefield and Barrier Location		X	
Combat Service Support (CSS)			
Electrical Energy Generation			
--Mobile			X
--Fixed Location		X	
PSYOPS			
--Leaflets Behind Lines		X	
--Fifth Column Aid/Equipment		X	
--TV/Radio Programming	X		
Military Police			
--Battlefield Circulation Control		X	
--Area Security Operations		X	
--Enemy POW Identification/Position/Monitoring		X	
--Refugee Control		X	
Illumination			
--Mirrors (Solar Reflector)		X	
--Laser		X	
--IR		X	
Weather Modification			

--Heat		X	
--Cold			X
--Precipitation			X
Supply			
--Location/Placement of Logistical Assets		X	
--Track, Control and Prioritize Expenditures		X	
----Bar Code Monitoring		X	
----Paperless Requisition System	X		
----Real Time Database Management	X		
--Preposition Selected Classes on Space	X		
--Robotic Storage and Retrieval		X	
--Space or Ground Launched, Quick Response Resupply Modules		X	
--Pop-up Suborbital Quick Response Resupply Modules		X	
--Quick Response Commo with Depot/NICP	X		
----MMC Remains at Home	X		
----MMC Phased Out		X	
--Fewer Supplies Required Due to More Efficient and Less Systems on the Battlefield			X
--Select MSR and Pipeline Routes	X		
--Locate Sources of Fresh Water	X		
Transportation			
--Navigation	X		
--Planning Data Provided			
----Trafficability	X		
----Cargo Inventory		X	
--Sea Conditions for Logistics Over the Shore Operations	X		
--Movement Management Control of Transportation Assets World Wide	X		
----Precision Location		X	
--Robotic Transloading		X	
--Remoted/Automated Resupply Convoys and Rear Area Troop Transport		X	
--Autonomous Resupply Convoys and Troop Transport			X
--Second Generation Shuttle Transport		X	
--Remoted Traffic Control Points, Highway Regulation Points, Trailer Transfer Points		X	
Maintenance			
--Remote Diagnostics	X		

--Automated Diagnostics		X	
--Position Location of All Critical Vehicles and Equipment		X	
--Remote/Automated Management and Administration		X	
--Robotic Recovery		X	
--Robotic Repair			X
--Maintenance of Army Space Systems		X	
Graves Registration			
--Individual Remains Position Monitoring and Identification		X	
--Robotic Evacuation		X	
--Location of Temporary Internment and Mass Burial Sites		X	
--Automated Remote Administration	X		
Health Services			
--Individual Soldier Monitoring			X
--Remote Diagnosis Sent to a Location Where Request Medical Expertise is Available			X
--Automatic Drug Application		X	
--Robotic Evacuation		X	
--Automated Remote Adminstration	X		
--Emergency Rapid Resupply		X	
Personnel Services			
--Automated Remote Adminstration	X		
--Two Way Electronic Mail		X	
--Low Signature Individual Position Location		X	
--Location and Monitoring of MIA/POW		X	
Combat Support, NBC (NBC)			
Employment - Surgical Application		X	
Hazardous Waste Disposal into Sun	X		
Warning of Incoming Delivery Means		X	
Individual NBC Alarm Warning		X	
Detection/Monitoring in Conjunction with Ground Sensors	X		
Three Dimensional Remote Sensing of Ground Contamination		X	
Unattended Decontamination (Robotics)		X	

Aviation (AVN)			
Navigation			
--Location	X		
--Altitiude			
----Mean Sea Level (MSL)	X		
----Above Ground Level (AGL)	X		
--Distance to Destination	X		
--Heading/Course	X		
--ETA	X		
--Speed			
----True Air Speed	X		
----Ground Speed	X		
--Terrain Avoidance		X	
--Digitized Mapping in Cockpit	X		
Air Defense Suppression		X	
Airspace Management			
--Army Airspace Command and Control	X		
--Joint Use Airspace	X		
--IFF			
----Active	X		
----Passive		X	
Control of RPVs from Space			X
Search and Rescue			
--Position Location	X		
--Survival Needs from Orbit or Suborbit Launch		X	

Source LTC Theodore T. Sendak, Army Role in Space: Design of an Army Corps Incorporating Space Capabilities, Carlisle Barracks: US Army War College, May 1986, pp. 19-25.

TABLE 3

RESOLUTION REQUIRED FOR DIFFERENT LEVELS OF PRECISION

Target	Detection	General Identification	Precise Identification	Description	Technical intelligence
Bridge	20 ft	15 ft	5 ft	3 ft	1 ft
Communications Radar/Radio	10 ft/10 ft	3 ft/5 ft	1 ft/1 ft	6 in/6 in	1.5 in/6in
Supply Dump	5 ft	2 ft	1 ft	1 in	1 in
Troop Units (Bivouac,Road)	20 ft	7 ft	4 ft	1 ft	3 in
Airfield Fac.	20 ft	15 ft	10 ft	1 ft	6 in
Rockets & Arty	3 ft	2 ft	6 in	2 in	.4 in
Aircraft	15 ft	5 ft	3 ft	6 in	1 in
Command & Control HQ	10 ft	5 ft	3 ft	6 in	1 in
Missile Sites (SSM,SAM)	10 ft	5 ft	2 ft	1 ft	3 in
Surface Ships	25 ft	15 ft	2 ft	1 ft	3 in
Nuclear Wpn Components	8 ft	5 ft	1 ft	1 in	.4 in
Vehicles	5 ft	2 ft	1 ft	2 in	1 in
Land Minefields	30 ft	20 ft	3 ft	1 in	-
Port & Harbors	100 ft	50 ft	20 ft	10 ft	1 ft
Coasts & Landing Beaches	100 ft	15 ft	10 ft	5 ft	3 in
Railroads, Yds and Shops	100 ft	50 ft	20 ft	5 ft	2 ft
Roads	30 ft	20 ft	6 ft	2 ft	6 in
Urban Area	200 ft	100 ft	10 ft	10 ft	1 ft
Terrain		300 ft	15 ft	5 ft	6 in
Surfaced Submarines	100 ft	20 ft	5 ft	3 ft	1 in

(Source: Adapted from Senate Committee on Commerce, Science, and Transportation, NASA Authorization for Fiscal Year 1978, Part 3 (Washington: Government Printing Office. 1977). pp.1642-43 and Bhupendra Jasani (ed.). Outer Space- A New Dimension in the Arms Race (Cambridge: Oelgeschlager. Gunn & Hain. 1982). p.47.)

Source: Jeffrey Richelson, "The Keyhole Satellite Program" The Journal of Strategic Studies, Volume 7, June 1984, p.124.

TABLE 4

SPACE SUPPORT FOR OPERATIONAL MANEUVER

		Operational Maneuver Considerations: Opn'l & Msn Anlys	Intel & Tact Anlys	Secty & Decpn	Cmd & Cntl	Commo	Mngmt of Resrc
S	Close Cmbt			F	M	M	
P	Navigation	N	N	N	N	N/M	
A	Fire Support		M	M			
C	Air Defense		M				
E	Commo					N/M	
	Command				N/M		
S	Control				N/M		
U	Intelligence	N/M	N/M				
P	Elec Warfare		X	X		X	
P	Recon & Survl	N/M	N/M		N/M		
O	Aviation		N/M	N/M			
R	IPB	N/M	M				
T	Cbt Spt to Engr	M/F	M/F				
	Mine warfare	M/F	M/F				
S	Mapping		N				
Y	Charting		N				
S	Geodesy		N				
T	CSS						N/M/F
E	CS to NBC Ops						M
M							
S							

Space support to operational maneuver will be available in the time frames identified:

N - available in Near term
M - available in Mid term
F - available in Far term
X - General Support Available

Space support capabilities are matched to the operational maneuver area of consideration noted. Specific factors and systems can be identified by cross referencing table 1 and table 2.

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